BELT DRIVEN VIBRATORY APPARATUS

TECHNICAL FIELD

The present invention relates generally to vibratory feed equipment such as for handling food products or like material, and more particularly to a vibratory apparatus for effecting the desired vibratory motion of an associated conveyor or the like, wherein the apparatus includes belt-driven, eccentrically-mounted vibratory weights for low-cost fabrication and maintenance.

BACKGROUND OF THE INVENTION

Vibratory feed equipment and conveyors are typically used for handling of materials which may not lend themselves to handling such as by conventional belt conveying equipment. Such vibratory devices can be advantageously employed for handling of bulk food products, such as corn, green beans, bulk frozen food products (such as french fries) and the like. Such vibratory feed equipment can also be advantageously employed for handling of bulk non-food products, such as coal or other minerals. The versatility of such vibratory conveying devices permits them to be readily used in combination with associated size-screening arrangements, flow-controlling discharge gates, and like material-handling components.

Typical vibratory conveying systems have heretofore employed one or more eccentrically-mounted rotatable weights or masses, the rotation of which imparts vibratory forces to associated conveying structures, such as elongated chutes or conveyor beds. In the past, the vibration-generating components of such equipment have included pairs of counter-rotating shafts interconnected by gear drives to effect synchronous counter-rotation, and in turn, counter-rotation of eccentrically-mounted weights carried by the shafts. While such constructions are capable of creating the desired vibratory forces for product conveyance, the gear drives of such previously-known arrangements are relatively expensive, typically requiring cast shaft mountings, and precise machining and assembly of the gear-driven components. It is ordinarily required that the gear drives be disposed in suitable lubrication oil, thus requiring that the gears be suitably housed and sealed. Additionally, gear drives such as described can create undesirably high levels of noise.

In view of the versatility of application of vibratory conveying arrangements, the present invention is directed to a vibration-creating vibratory apparatus which is particularly configured for cost-efficient manufacture and maintenance.

SUMMARY OF THE INVENTION

A vibratory apparatus embodying the principles of the present invention desirably avoids the use of any gear-driven components, and instead effects counter-rotation of a pair of shafts of the apparatus by appropriate belt drives. By virtue of the belt-driven arrangement of the device, the high cost associated with fabrication and maintenance of typical gear-driven vibratory devices is desirably avoided. Additionally, the belt-driven vibratory apparatus of the present invention is desirably quieter than typical gear-driven arrangements. In accordance with the preferred embodiment, bearing assemblies of the apparatus are positioned for efficient periodic maintenance, with the apparatus including a housing in the form of a fabricated composite beam assembly to facilitate economical manufacture, and versatile integration of the apparatus with associated vibratory conveying equipment.

In accordance with the illustrated embodiment, the present vibratory apparatus includes a housing, and first and second counter-rotating shafts rotatably mounted on the housing in parallel relationship to each other. Vibratory forces are created by the provision of first and second vibratory weights respectively eccentrically mounted on the first and second shafts. The vibratory weights are mounted so that counter-rotation of the weights causes the weights to create vibratory forces through the housing, perpendicular to the axes of the shafts.

First and second drive pulleys are respectively mounted on the first and second shafts, with each of the drive pulleys preferably having a toothed configuration. A drive belt interconnects the first and second drive pulleys for synchronous counter-rotation of the first and second drive shafts. In accordance with the present invention, the drive belt comprises a double-sided toothed belt trained about the first and second toothed drive pulleys so that one side of the tooth belt engages one of the toothed drive pulleys, and the other side of the tooth belt engages the other one of the toothed drive pulleys. In this manner, counter-rotation of the first and second drive shafts is effected.

Counter-rotation of the first and second drive shafts is effected by an electric drive motor of the present apparatus, which motor is operatively connected with at least one of the drive shafts for effecting shaft rotation, and attendant vibratory motion of the eccentrically mounted vibratory weights. In one illustrated embodiment, the drive motor is operatively connected with the first one of the dive shafts for effecting driven rotation thereof, with the double-sided toothed drive belt interconnecting the first and second drive shafts so that driven rotation of the first drive shaft effects driven rotation of the second drive shaft via the drive belt. In an alternate embodiment, the drive belt interconnecting the first and second drive shaft also is operatively connected with the drive motor, with a single belt thus effecting driven rotation of the shafts, as well as interconnection of the shafts for synchronous counter-rotation.

In view of the eccentrically-mounted nature of the vibratory weights of the apparatus, the drive shafts of the apparatus, and their associated bearing arrangements, are subjected to relatively high degrees of vibration and wear. Accordingly, the apparatus includes first and second pairs of bearings for respectively rotatably mounting the first and second drive shafts on the housing of the apparatus. Notably, each pair of the bearings is mounted on, and accessible from, the exterior surface of the housing to facilitate maintenance, and periodic replacement as required, of the bearings. A particularly preferred bearing assembly, as hereinafter will be described, facilitates such periodic maintenance.

Other features and advantages of the present invention will become readily apparent from the following detailed description, the accompanying drawings, and the appended claims.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a perspective view of a vibratory apparatus embodying the principles of the present invention;

FIG. **2** is a perspective view of the vibratory apparatus shown in FIG. **1**, with cover components thereof removed for illustration of interior components of the apparatus;

FIG. **3** is a perspective view similar to FIG. **2** illustrating a toothed belt drive arrangement of the present apparatus;

FIG. **4** is a diagrammatic view illustrating, in side elevation, counter-rotating components of the present vibratory apparatus;